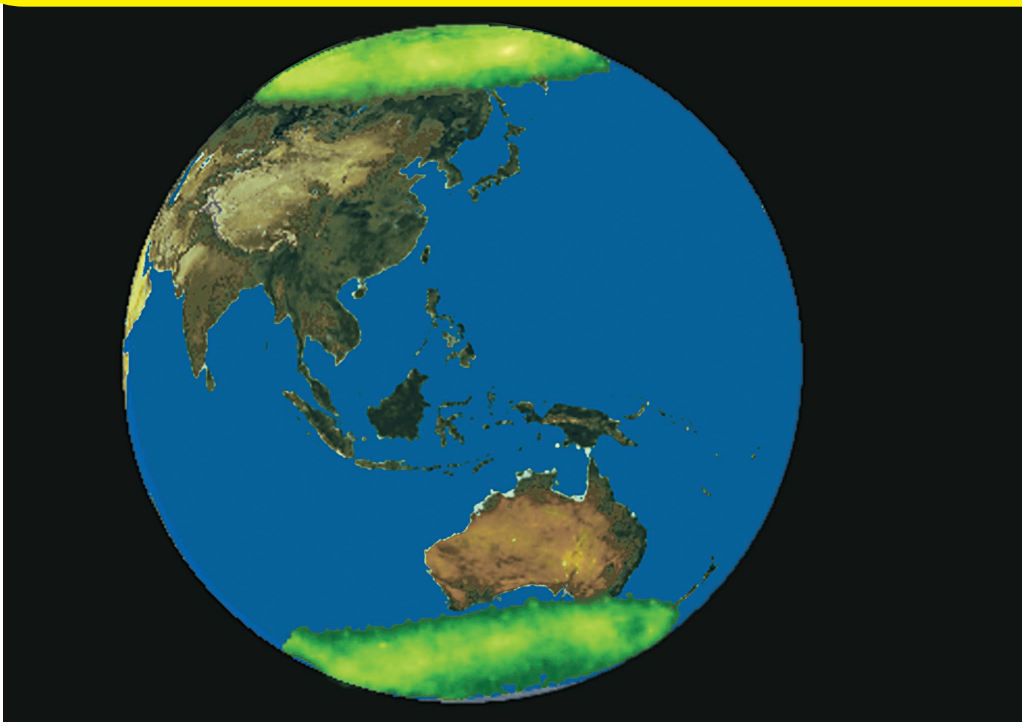
CHAPTER 8

Fields and Their Applications

CHAPTER CONTENTS

PREREQUISITE CONCEPTS AND SKILLS

- Newton's law of universal gravitation
- Electric potential difference
- Magnetic fields
- Moving charges in magnetic fields



The photograph above is the first image ever obtained of auroras at both the North Pole and the South Pole at the same time — a reminder that Earth's magnetic field protects all living organisms from frequent bombardment by high-energy, charged particles in the solar wind.

When the onslaught of charged particles enters Earth's magnetic field at an angle with the field, they curve away from Earth's surface. Many of the particles become trapped in the magnetic field and follow a helical path, circling back and forth in the field for long periods of time. These ions form the ionosphere. Only at the magnetic poles do the charged particles enter Earth's magnetic field parallel to the field lines and, therefore, are not diverted from their path. As these particles collide with oxygen and nitrogen molecules in the atmosphere, they excite the molecules, which then emit light as they return to their ground state.

Electric, magnetic, and gravitational fields exert a great influence on the structures in the universe. In this chapter, you will study how scientists and engineers are able to construct and manipulate some fields for practical purposes. The study of the behaviour of electric and magnetic fields has led to great progress in our understanding of the electromagnetic field and its enormous significance in, for example, telecommuncations.